Space Weather Technical Forecast

Issued on Wednesday, 17 May 2023 at 13:29 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Relatively quiet solar wind. Chance of R1/R2 radio blackouts. Chance of unsettled or active periods of geomagnetism on days 3 and 4.
Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been High over the last 24 hours, with the largest event an M9.6 flare (likely X-class due to obscurity out of view), which was observed yesterday at 16/1643 UTC from a region just behind the southeast limb now coming into view on the visible disc. Otherwise, X-ray activity has been at background C-class throughout. There are currently six numbered sunspot regions on the visible disc, with the new M-flare region currently unnumbered. AR3305 remains the largest fully-visible and most complex region on the disc, but remains relatively quiet. A very faint CME emerged off the SE limb following the recent M9.6 flare which is currently not expected to be Earth-directed. A much larger CME occurred on the backside of the Sun just before the M9.6 flare and is considered no threat to Earth. Several large filaments are currently present on the visible disc, some showing signs of instability. However currently, no Earth-directed CMEs have been observed in the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR at L1, was slightly Elevated through the period, on a downward trend from around 480km/s to 430km/s. The Phi angle has been near neutral or pointing away from the Sun. The solar wind density was average throughout, also with a falling trend. The IMF was also at ambient strengths between 5 and 6 nT whilst the Bz remained mainly positive. As a result, geomagnetic activity over the past 24 hours was mainly Quiet (Kp1-2).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV), as measured at GOES16, became slightly elevated following either the M9.6 flare or large back-sided CME at the same time, but remained well below the active S1/minor storm threshold. High energy electron flux (greater than 2MeV), as measured at GOES16 was at low background levels. The 24-hour integrated fluence has been well below Active levels. At 17/0001UTC, 2.17e6 integrated pfu was recorded.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity will be mainly Low (C-class), but with a chance of isolated Moderate (M-Class) flares, notably down to a new large region which is currently rotating into view around the southeast limb which has a history of high M-flares.

Solar Wind / Geomagnetic Activity: Solar winds are expected to be near ambient for the most part, with no CMEs or coronal hole fast winds until the wind from CH03/04 perhaps passes over Earth later on Day 3 (19 May). Geomagnetic activity is expected to be mostly Quiet as a result until then (Kp0-2) with a chance of Unsettled or Active levels (Kp3-4) by days 3 and 4 (19-20 May).

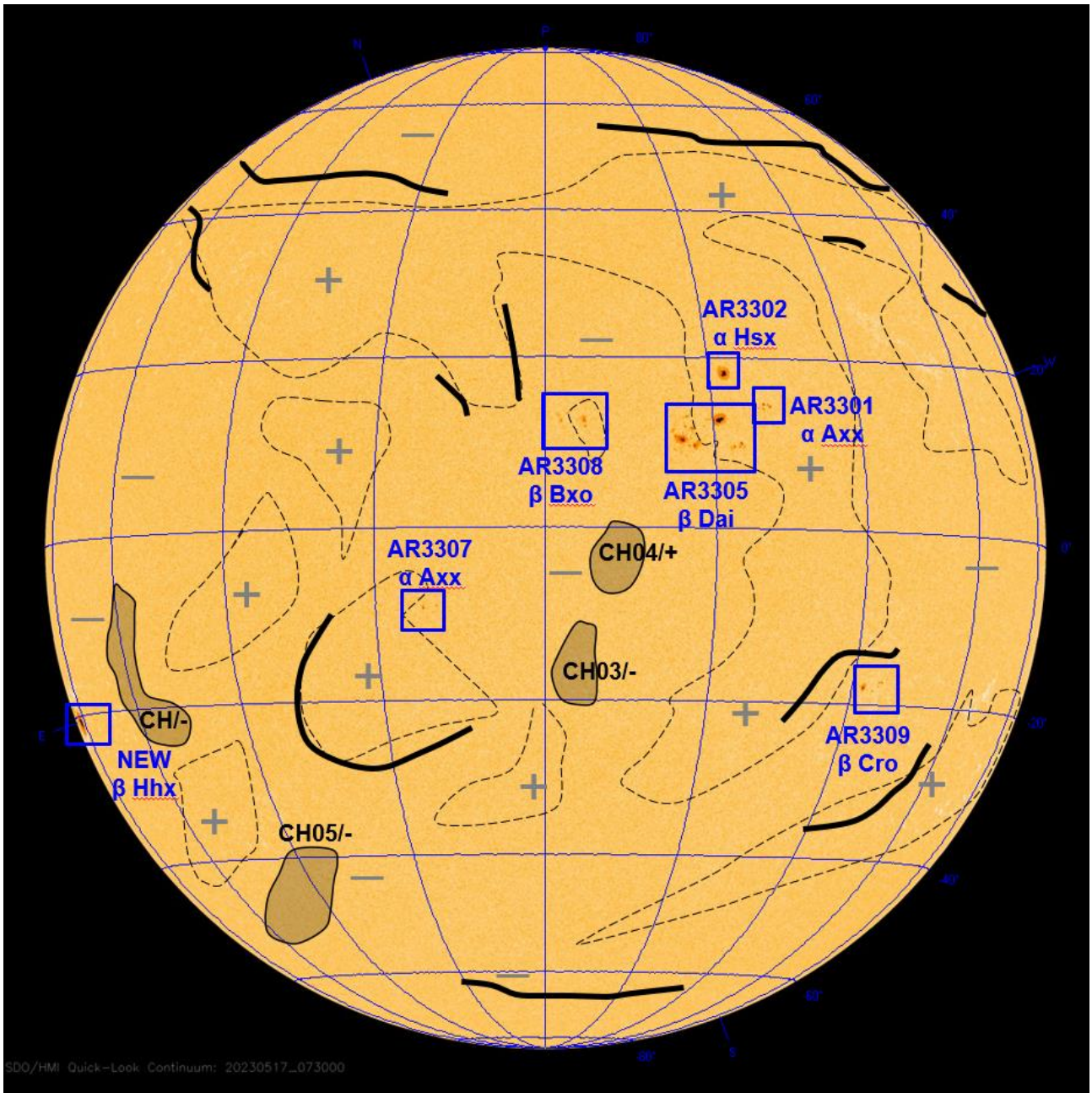
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is currently elevated but not expected to breach S1 threshold, therefore assuming no further flares

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

during the 4 day period, it should remain at background tolerances. High energy electron flux (greater than 2MeV) is expected to remain at background levels, as is the associated 24-hour fluence.

Figure 1. Solar Analysis Valid 17/0800UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Met Office Space Weather Technical Forecast

Geomagnetic Storms:

The solar wind is currently at slightly elevated levels, but slowly easing down back to ambient. There are currently no CMEs now expected during the forecast period. There are two small coronal holes centre-disc which could elevate the solar wind again at Earth by Day 3 and 4 (19th-20th) with a slight chance of an isolated G1 minor storm, but most likely seeing Unsettled to Active periods (Kp3-4).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections – None Expected

Radio Blackouts - X-Ray Flares:

There are currently seven sunspot regions on the visible disc, the majority of which are decaying unipolar or else minor bipolar groups. The two exceptions to this are AR3305 and a new region currently rotating around the southeast limb which was responsible for the M9.6 flare yesterday (likely X-class had it been in full-view). AR3305 has yet to produce any significant flare activity, perhaps because for all its increase in size and number of spots it remains fairly neatly a straightforward Mt Wilson Beta group. The statistical probability of M-flares (R1-R2) is around 20% at the moment, but based on the recent history of the new sunspot this has now been increased to 50% chance, with a 10% chance of an isolated X flare.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	50	50	50	50
Very Active	R3 to R5 X Class	No	10	10	10	10

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux, as observed by GOES16 became slightly elevated yesterday, either caused by the recent M9.6 flare observed at 16/1643 UTC or from the large back-sided CME which occurred at a similar time. However, the proton flux has remained below the S1/minor threshold, and is currently expected to remain below unless any further large flares occur.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) has remained at normal Background levels over the past 24 hours, and this is likely to remain the case through the coming four days in the expected absence of any drivers for increasing counts. Perhaps elevating a little if we get an elevated wind from coronal holes 19th May onwards. The corresponding 24-hour fluence is also expected to remain well below the active threshold.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.